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ABSTRACT

A study investigated the relationships between academic self-concepts, metacognitive problem solving, and ethnicity in entering college freshmen minority men and women. The study hypothesized, first, a positive relationship between metacognitive problem solving skills and academic self-concepts, and second that there would be ethnic differences between self-concepts and metacognition and the relationships between them. A sample of 214 urban university students (42 percent Black, 31 percent Hispanic, 18 percent Asian and 2 percent White). Students responded to several research instruments including: (1) a 42-item Likert scale assessing the types of and frequencies of metacognitive thinking; (2) an eight item instrument assessing students' general academic self-concept; and (3) an instrument assessing self-concept in mathematics, English, science and social studies. The results indicated that despite variability due to ethnicity and gender, there was a moderately positive relationship between students' self-reports of their metacognitive activities and their self-concepts. The strongest relationships were between general self-concept and subject-specific self-concepts. Ethnicity results showed that Asians had the strongest intercorrelations of metacognition and general self-concept. Included are three tables, 2 figures, and 16 references. (JB)

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Self Concept and Metacognition in Ethnic Minorities

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ABSTRACT

This study investigated the relationships between academic self concepts, metacognitive problem solving, and ethnicity. It tested two predictions derived from the BACEIS model of cognitive, affective, and environmental factors that affect intellectual performance. There were two predictions: that there would be positive relationships between metacognition and academic self concepts; and that there would be ethnic differences in metacognition, academic self concepts, and the relationships between them. The results confirmed the predictions. Implications for research and instruction are discussed.

The BACEIS model is a comprehensive framework of internal (cognitive and affective) and external (academic and nonacademic environments) factors affecting intellectual performance (Hartman & Sternberg, 1991). It suggests that self concept and metacognition may be interrelated and affected by cultual values. Differences between cultures may be reflected in the beliefs and attitudes of students from different ethnic groups. The interaction of these factors may have implications for how and the extent to which students engage in academic work. These factors may also help explain observed differences between students from different ethnic groups in their academic success. Eventually such information may be useful for designing instruction which improves students' academic performance.

Internal Factors

Research supports a view of self concept as multifaceted, hierarchical, and gender-linked. There has been considerable research showing interrelationships between such variables as self concept, test anxiety, locus of control, and achievement. Krampen (1988) found evidence of causal relations between subject-specific self concept, locus of control and test anxiety. College success was effectively predicted for high achievers from measures of academic self concept and high school grade point average; success for low achievers was best predicted from internal locus of control (Korrel-Kanoy, Wester, & Latta (1989). Griffore & Griffore (1982) found that changes in academic self

concept and test anxiety coincided with the degree of achievement for first term college students. Changes occurred primarily with low achieving students. Low math self concept, combined with low internality and high chance control predicted test anxiety. Marsh's (1986) internal/external frame of reference model of self concept posits self concepts are constructed through internal comparisons, such as "I am better in math than I am in English" as well as external comparisons, such as, " Most students in my class are better in math than I am ". This model is designed to explain the formation of verbal and math self concepts. Does metacognition mediate internal and external comparison processes?

There has been scant attention to the relationship between self concept and metacognition. Recent research has indicated that metacognitive monitoring and self regulating processes have important relationships to students' performance on academic tasks. Schoenfeld (1987) identified metacognitive self-regulatory problem solving processes needed for successful problem solving in the field of mathematics. Both forms of metacognition, executive management (planning, monitoring, and evaluating/revising) and strategic knowledge (declarative, contextual and procedural) may impact on self concept. Appropriate use of metacognition during problem solving enables awareness and control over problem solving, which generally improves the liklihood of success. Success experiences have long been recognized as the key factor leading to the development of positive self concepts. Thus, successful problem solving should

promote the development of positive academic self concepts.

External Factors

Does ethnicity have any effect on these internal processes or the relationships between them? Mestre (1989) cites research which identifies cultural factors affecting learning math. He argues that comprehensive attempts to improve math education for minorities must take into account cultural, linguistic, socioeconomic, and attitudinal factors.

Cognitive style research has demonstrated that variations within ethnic groups are generally greater than variations between them. Additionally, various cultures tend to show considerable overlap. (Shipman & Shipman, 1985). However, Anderson (1988) suggests that college retention programs have not been very successful with ethnic minorities in part because of the ethnocentric assumption that minorities have the same cognitive framework as whites. He argues that this assumption leads retention program developers to base their approach on learning theories based on Anglo-European views about learning, achievement, and cognitive functioning. Anderson observes that these programs rarely attempt to identify the learning preferences and cognitive assets of non-white students.

Upon awareness of the high failure rate of black students in freshman calculus, Treisman (1985) examined the academic behavior of Black and Asian students through interviews and observations. He found that black students, unlike Chinese, rarely studied with classmates. Chinese students often worked in informal study

groups. Cooperative work with a shared purpose enabled students to share their mathematical knowledge, check out their understanding of academic requirements, question and critique each other. Consequently, cooperative learning faciltates both content acquisition and metacognition. Additionally, while Black students worked approximately eight hours a week on their math course, Chinese students worked around fourteen hours per week on the same tasks. Finally, black students rarely utilized the free tutoring provided on campus, because they viewed themselves as self-reliant (which was one of their greatest strengths before college). When tutoring did occur - it primarily focused on material design to move students from D or F to C; there was little emphasis on getting students to a B or A. Based on these findings Treisman designed an academic support Workshop program in which black students worked collaboratively on difficult problem sets for six to eight hours per week. Treisman found that black Workshop participants **consistently** earned one full grade higher, on average, than black students who did not participate in the workshops. Retention was also improved. Workshop participants' persistence rate was 76% after the first two years in college, while the persistence rate of non-Workshop participants was 57%.

Thus the literature suggests that students may benefit from adopting approaches and attitudes different from their own, and that sometimes these approaches are differentiated by ethnicity. Cultural background and values may influence students' affect and

cognition as well as the relationship between affect and cognition. At the college where this research was conducted minority students enrolled in science and engineering programs are more likely to be Asian than Black or Hispanic - in disproportionately high representation compared to their overall enrollment. Why? Are there differences between the groups in their internal processes that affect intellectual performance? This study is a beginning investigation of whether ethnicity has any relationship to and between metacognition and self concepts. We test two BACEIS model derived predictions about metacognitive problem solving and academic self concepts in entering freshmen minority men and women. First, we hypothesize a positive relationship between metacognitive problem solving and academic self concepts, both general and subject-specific. Second, we hypothesize ethnic differences between self concepts and metacognition and the relationships between them.

Method

Procedures

Students responded to several research instruments: 1) A newly developed the Thinking About Problem Solving (TAPS) scale, 42 item Likert scale assessing the types and frequencies of metacognitive planning, monitoring, and evaluating processes used by students during problem solving (Alpha reliability = .90), 2) The Michigan State Self-Concept of Ability Scale,(Brookover, Le Pere, Hamachek & Erickson, 1965), an 8 item instrument assessing students' general academic self concept, (Alpha reliability =

.78) and, 3) the version of the same instrument assessing self concept in four content areas: mathematics (Alpha reliability = .93), science (Alpha reliability = .93), English (Alpha reliability = .93), and social studies (Alpha reliability =.90).

Data Source

Subjects were N=214 entering students, (N=139 male, N=75 female) to a large urban university, attending the second day of a pre-freshman summer program designed to improve their basic skills before starting their formal college experience. Most students belonged to ethnic minorities: Black = 41.9%, Hispanic = 31.4%, Asian = 18.1%, White = 2.4% and Other = 6.2%.

Results

Zero-order correlations were computed between the metacognition measure, Thinking About Problem Solving Scale, (TAPS) and the different self concept indices. These indicated that the TAPS had moderately positive relationships with other variables: general self concept, $r = .28$, $p < .001$; math self concept, $r = .23$, $p < .01$); English self concept, $r = .25$, $p < .001$); science self concept, $r = .21$, $p < .05$; and social studies self concept, $r = .09$. (See Table 1).

(insert Table 1 around here)

Multiple correlations between all self concept measures and the TAPS are .34 ($F = 3.57$, $df = 5, 153$, $p < .01$.).

Intercorrelations of metacognition and self concept by ethnic group indicated that the TAPS had the following relationships with self concept for both Blacks and Hispanics:

general, r = .22, math, r = .28, $p < .05$; science .17, social studies .10, and English, 24. ; for Asians: general, r = .34, $p < .05$; math, r = .22, science .40, $p < .05$; social studies .38, $p < .05$; and English, .20. (See Table 1). The strongest relationships are between general and subject-specific self concepts, and between science and math, and between English and social studies. There is less of a relationship across pairs, i.e. between science and social studies or math and English.

Correlations between self concept and metacognition during problem solving were highest among Asian students (r = .32, n = 36, $p < .05$) compared to all other groups and were higher for males (.34) than females (.18). The means and standard deviations are presented in Table 2. Black students scored higher than Hispanics and Asians on all scales (metacognition and self concept) except self concept in mathematics. Asians scored lowest in metacognition, general self concept, and self concept in English. Hispanics scored lowest in self concept in math, science and social studies. Males scored slightly higher than females on all scales, except self concept in English. On all scales except general self concept, women varied more than men.

(insert Table 2 around here)

Analysis of variance of ethnic and sex differences resulted in a significant main effect due to ethnicity in metacognition and general self concept, and math and English self concepts. ANOVA found significant differences among Black (n = 75), Hispanic (n = 59), and Asian students in general self concept (F

= 5.66, df = 2, 112 , p < .01). Similar differences were found in TAPS scores (F = 5.97, df = 2,112, p <.01), with Asian students having the lowest scores on both variables. (Table 3) There was a significant main effect due to sex in self concept in math and science.

(insert Table 3 around here)

Additionally, there was a significant sex by ethnicity interaction in metacognition and in math self concept (see Figures 1 and 2). Overall, women varied more by ethnic group than men. Hispanic and Asian women rated themselves more poorly compared to men in their groups than did Black wormen, who rated themselves more highly than black men. Asian women's self ratings, although lower than Asian men's, were not as much lower as Hispanic women's self-ratings were relative to Hispanic men. (Figure 1). Men did not differ much by ethnic group in their math self concept. Black and Hispanic women were similar to each other in their math self ratings (lower than men of their respective group), but Asian women rated themselves much more highly in math than Asian men.

(insert Figures 1 & 2 around here)

The results confirm the expected positive relationships between metacognition and students' general self concept, and their self concepts in English, mathematics, science, and social Studies. Additionally, the results confirm predicted ethnic differences in self concept and metacognition and their relationship. Finally, the results add to the construct validity

of the metacognition scale. The results suggest several directions for further research.

Discussion

This research has indicated that despite variability attributable to ethnicity and gender, there is a moderately positive relationship between students' self reports of their metacognitive activities and their self concepts. The zero-order correlations were somewhat low, although statistically significant, while the multiple correlations were moderate. The strongest relationships are between general self-concept and subject-specific self concepts; and between science and math, and English and social studies. There is less of a relationship across these pairs, i.e. between science and social studies or math and English.

The correlations between metacognition and self concept were higher for general self concept than for subject-specific self concepts. English self concept had the strongest subject-specific relationship to report use of metacognition. Since many of our students do not have English as their native language, the English self concept may permeate academic life across subjects, thereby operating similar to the general academic self concept. Students' beliefs about their metacognition may similarly permeate their views about their ability to do academic work in general, more than within specific subjects.

Ethnicity results show Asian students had the strongest intercorrelations of metacognition and general self concept and

two subject-specific self concepts: science and social studies. Black and Hispanic students had the stongest intercorrelations of metacognition and math self concept. Intercorrelations of metacognition and self concept by ethnic group indicate that Black and Hispanic students have patterns of relationships between cognition and affect which are relatively similar to each other while relatively different from that of Asian students. However, each of the three ethnic groups showed distinct self concept profiles. Are there ethnic/cultural differences in students' tendencies to use internal versus external frames of reference when forming self concepts and making other self judgments? Might students differentially benefit from supplementing and/or modifying their frames of reference? Could students differentially benefit from programs like Invitational Education (Purkey & Novak, 1984) as a function of ethnicity?

The findings suggest that research should pursue further the relationships between metacognition and self concepts to clarify the present findings of differences in that relationship within and among ethnic groups and within and between males and females. Research on the affect-cognition relationship is vital if we are to have a more complete undertanding of these two domains, how they interact, and how they impact on college performance for students of various cultural backgrounds.

Why did Asian students score significantly lower on general self concept and metacognition measures than Black and Hispanic students? Why is the relationship between metacognition

and academic self concept stronger for Asian than other students? In a contrastive analysis of Chinese and English, Lay (1991) illustrates many interrelationships between Chinese language and thought and their differences from English. Lay notes that Chinese philosophy emphasizes looking at both sides of a picture and that this Yin/Yang concept has been virtually ignored by Westerners until recently. Do cultural values of reflection, self criticism, and practices like perspective shifting mediate students' metacognition, self perceptions, and academic performance? For example, do they influence students' self appraisal accuracy? How might cultural values affect the internal and external comparison processes involved in self concept formation? Treisman's research suggests that there are ethnic differences in students' academic work habits (blacks tending towards independence, Chinese tending towards cooperation) which result in different patterns of academic achievement. Artz & Armour-Thomas (in press) found that cooperative learning spontaneously elicits metacognition during math problem solving. Research identifying cultural effects on metacognition and self concepts may facilitate new instructional approaches to improve student achievement. Instructionally the results suggest that students from all ethnic groups may benefit from self concept development. However, there are bound to be variations both within and between ethnic groups, so one cannot stereotype students' affective or cognitive needs by ethnicity.

Since research has demonstrated that metacognition can be

taught to students effectively, further research should also examine whether students whose subject-specific metacognition improves also develop more positive, subject-specific self concepts. If so, are improvements related to the internal and/or external comparison processes hypothesized by Marsh (1986). Does this vary with cultural background? Of further interest should be similar research which studies whether improvement in students' metacognition, due to subject-specific or more generic metacognitive training, also leads to improvements in their general self concept.

Extending this study to the academic environment, are instructional techniques differentially effective for enhancing metacognition as a function of ethnicity? "Pair-problem solving" is a popular and effective method of improving performance through students alternating roles of "thinker" and "listener" (Whimbey & Lockhead, 1982). Ancedotal evidence from training hundreds of tutors in this method suggests that cultural values of the privacy of thought may affect receptiveness to the role of thinker. Thinking aloud may violate privacy. Is use of the pair problem solving method affected by ethnicity? In followup research, a variety of other paradigms may be used. Videotapes and/or verbal protocols of multicultural students in tutoring and cooperative learning settings could be examined for choice and impact of various instructional techniques, like pair problem solving. Multicultural students with varying metacognitive performance may be studied for evidence of differences in self

concept and related affective variables.

As our population becomes increasingly pluralistic, we need to reexamine what and how we teach. Racial, linguistic, social and economic diversity requires teaching methods which accommodate heterogeneous achievement levels and cultural backgrounds (Becker, 1990). Results from this study provide some support for the BACEIS model as a useful tool for predicting relationships among factors which may affect intelligent behavior. The relationships between cognitive, affective, and environmental factors need to be examined further to fully understand and exploit their impact on academic performance. Additional tests of the BACEIS model leading to clarification of relationships between cognitive and affective variables and their relationships to features of the academic and nonacademic environments could contribute to improved understanding of the many factors affecting students' learning from instruction.

Table 1

Intercorrelations of Metacognition and Self-Concept by Ethnic Group

	SC(Gen)	SC(Math)	SC(Sci)	SC(SS)	SC(Eng)
Total N=143					
TAPS	.28**	.23**	.21*	.09	.25**
SC (Gen)		.55**	.59**	.52**	.59**
SC(Math)			.52**	.24**	.16
SC(Sci)				.39**	.29**
SC(SS)					.52**
Multiple correlation of self-concept measures with TAPS:					.34**
Black (n=63)					
TAPS	.22	.28*	.17	.10	.24
SC (Gen)		.59**	.51**	.56**	.61**
SC(Math)			.37*	.25*	.19
SC(Sci)				.45**	.33**
SC(SS)					.43**
Hispanic (N=45)					
TAPS	.22	.28*	.17	.10	.24
SC (Gen)		.59**	.51**	.56**	.61**
SC(Math)			.37**	.25*	.04
SC(Sci)				.16	.19
SC(SS)					.67**
Asian (n=35)					
TAPS	.34*	.22	.40*	.38*	.20
SC (Gen)		.80**	.79**	.60**	.51**
SC(Math)			.83**	.55**	.32
SC(Sci)				.62**	.41*
SC(SS)					.55**

*p <.05. **p < .01.

Table 2

Means and Standard Deviations

By Ethnicity

Scale	Black (n=63)		Hispanic (n=45)		Asian (n=35)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
TAPS	137.94	(13.2)	133.60	(14.5)	128.74	(13.3)
Self-Concept						
General	33.49	(3.6)	31.87	(2.9)	31.40	(4.0)
Mathematics	33.16	(5.3)	30.47	(6.3)	33.49	(5.5)
Science	32.05	(5.8)	29.49	(5.9)	31.89	(5.6)
Social Studies	30.94	(4.7)	29.18	(5.2)	29.34	(4.0)
English	31.63	(5.9)	29.73	(4.0)	27.09	(4.8)

By Sex

Scale	Males (n=87)		Females (n=56)	
	Mean	(SD)	Mean	(SD)
TAPS	134.77	(13.4)	133.63	(15.1)
Self-Concept				
General	32.70	(3.7)	32.11	(3.5)
Mathematics	33.41	(4.8)	30.80	(6.8)
Science	32.37	(5.6)	29.39	(5.8)
Social Studies	30.46	(5.1)	29.27	(5.8)
English	29.80	(5.2)	30.80	(6.8)

Table 3

Analysis of Variance of Sex and Ethnic Differences in Metacognition and Self-Concept

Dependent	Sex F	Ethnicity F	Sex x Ethnicity F
TAPS	1.44	5.97**	3.14*
SC(Gen)	2.22	5.66**	1.99
SC(Math)	5.79*	3.12*	3.76*
SC(Sci)	8.48**	2.50	2.24
SC(SS)	2.95	2.68	1.59
SC(Eng)	.32	9.01***	.14

N = 143. *p < .05. **p < .01. ***p < .001.

Figure 1

Interaction of Gender and Ethnicity in Metacognition

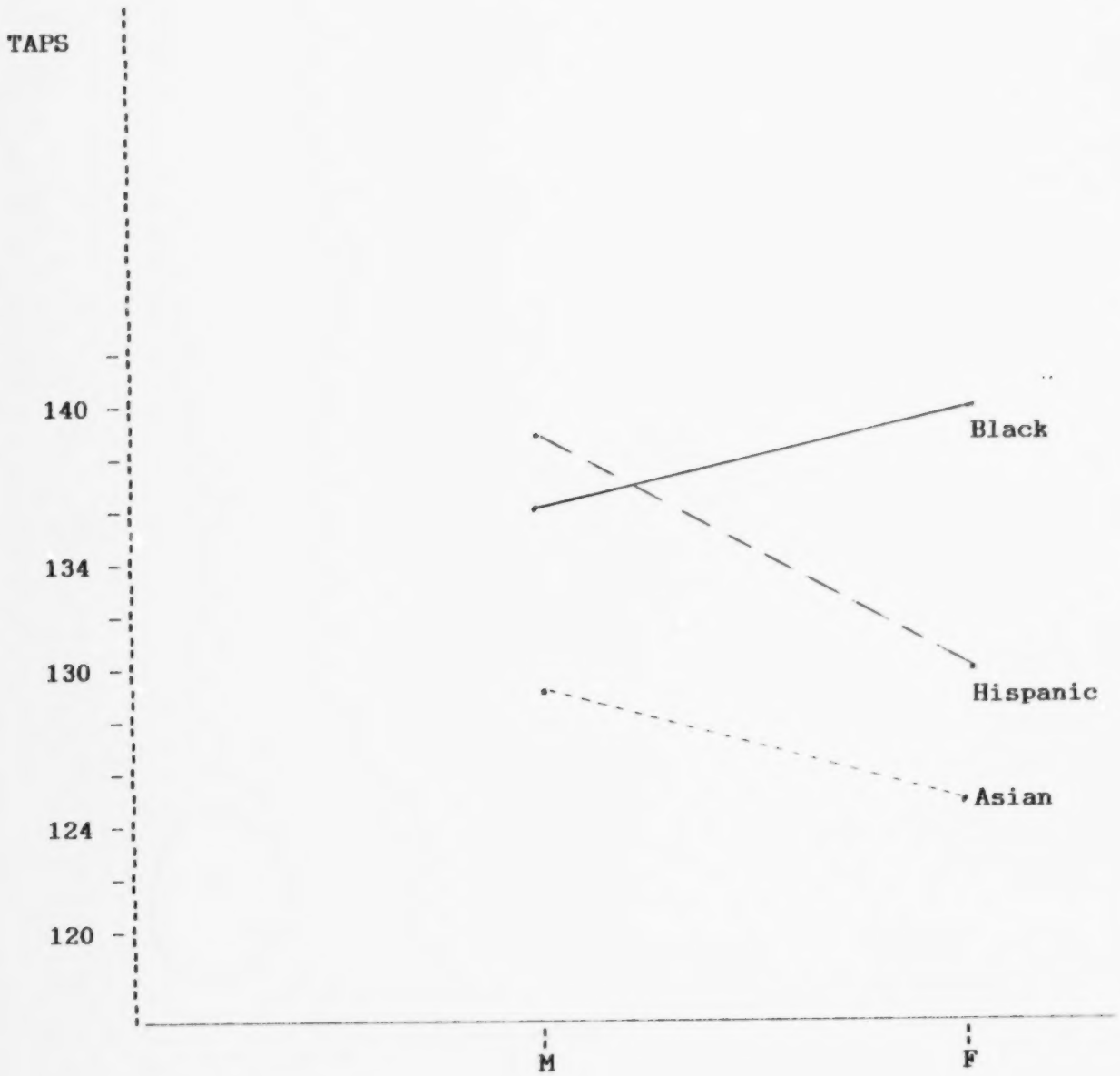
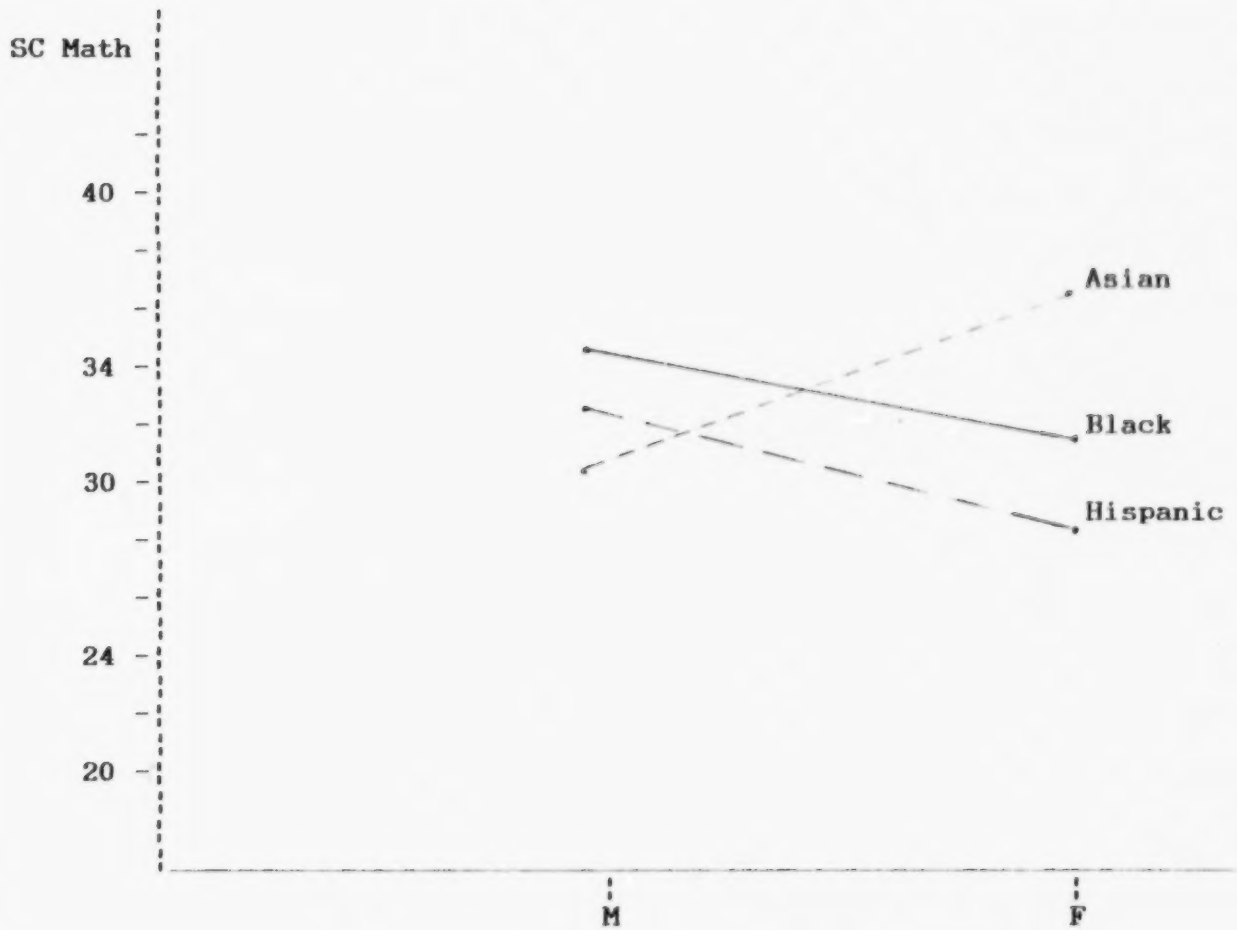


Figure 2

Interaction of Gender and Ethnicity in Self-concept in Mathematics



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